

*Measurement of Rotatory Dispersive Power in the Visible and
Ultra-violet Regions of the Spectrum.*

By T. MARTIN LOWRY, D.Sc., Lecturer on Physical Chemistry and Instructor
in Crystallography at the Central Technical College.

(Communicated by Prof. Armstrong, F.R.S. Received November 3,—Read
November 19, 1908.)

The following is a brief preliminary account of improvements effected in the method of determining rotatory dispersive power which have made it possible to observe accurately not only in the bright regions of the visible spectrum, but throughout the scale from the region of the lithium red line into that commanded by the photographic plate.

Two methods have generally been used for the purpose, namely, (1) Broch's method, in which a spectroscope is arranged in series with the polarimeter and a narrow strip of a continuous spectrum is picked out for observation—a method which is much improved by using a constant-deviation spectroscope in place of one of the variable-deviation type,* and (2) Landolt's method, in which a white light is reduced by means of filters to approximate homogeneity in the red, green, light-blue, or dark-blue parts of the spectrum. Neither method fulfils the fundamental condition that the field of the polarimeter shall be uniformly lighted with monochromatic light—many of the measurements that have been made, therefore, possess only a qualitative value. A much better method is due to the late Sir William Perkin, who introduced the use of a spectroscope-eyepiece as a means of purifying the sodium light, and used it on a limited scale for measuring rotatory dispersive power in the red (lithium), yellow (sodium), and green (thallium) parts of the spectrum.

The method now described resembles Perkin's method in its essential feature, namely, the use of monochromatic or multichromatic light (spectroscopically purified) in place of a band from a continuous spectrum. It has the advantage that it renders available for polarimetric measurements, in addition to the flame spectra, the large series of intense line spectra produced by the metallic arcs, which, with the one exception of the enclosed mercury arc,† do not appear to have been used previously for this purpose. Up to the present, measurements have been made with 26 lines ranging from w.l. 6708 to w.l. 4359; beyond these limits the visual intensity of the light

* F. Twyman, 'Phil. Mag.,' 1907, vol. 13, p. 481.

† Disch, 'Ann. Phys.,' 1903 (4), vol. 12, p. 1155.

is so small that polarimetric observations become very difficult, but in the intermediate part of the spectrum the list might, without difficulty, be extended considerably. The mercury lines referred to in the table were produced by a Bastian lamp; the copper and zinc spectra were produced by means of copper or brass electrodes rotating in opposite directions, as recommended by Baly in the case of the iron arc; the cadmium spectrum was obtained by means of rotating copper or silver electrodes coated with the metal.

In order to utilise the arc spectra for polarimetric observations, a parallel beam from the arc is thrown on to the widely-opened slit of a constant-deviation spectroscope. An achromatic lens of 22" focus is substituted for the observing telescope of the spectroscope, and is used to cast a magnified image of the slit on to the polarising prisms which produce the horizontally-divided triple field of the polarimeter. By turning the constant-deviation prism to a suitable position, the field can be illuminated from top to bottom by a brilliant band of pure monochromatic light, the maximum width of the band being determined by the openness of the spectrum and, in a very important manner, by the efficiency of the dispersive system. By using a C.D. prism of high density in conjunction with the long-focus lens, it is possible to read separately the two lines 5790 and 5769 which constitute the yellow mercury doublet, although these differ in wave-length by only 21 Ångström units; the yellow doublet and green triplet in the copper spectrum can be read with ease and accuracy as broad bands each occupying a width rather greater than one-third of the 8-mm. aperture of the triple field; the chief lines in the mercury and cadmium spectra can be made to cover practically the whole field without overlapping. In order to eliminate stray light, which would give rise to serious errors in the red and violet readings, a Perkin spectroscopic eye-piece is used.

In measuring rotatory dispersive power in the ultra-violet, a parallel beam of light from an arc formed between a carbon and a magnetite electrode is cast directly by a quartz condenser on to the triple field of the polariser, Foucault prisms being substituted for the Nicol prisms to ensure transmission. A quartz-calcite lens of 13" focus is substituted for the analyser-telescope; this casts a diminished image of the triple field on the slit of an ultra-violet spectroscope. The spectrum thus produced is photographed in the ordinary way by means of a camera provided with a quartz-calcite lens of 22" focus; the division produced by the triple field can be seen clearly, and it is easy to pick out and identify on the negative the line which is of equal intensity in its three sections. By taking photographs with the analyser in different positions

it is possible to determine the rotatory power of a substance throughout the transmitted spectrum.

The results obtained with water, carbon bisulphide, and other liquids in a magnetic field will be dealt with in a later communication; the method is one which is likely to be of special value as affording a means of determining the homogeneity of apparently simple liquids.

The polarimeter readings shown in the table were usually concordant within a few hundredths of a degree: the absolute values may differ by as much as 1° in different specimens of the ester, but the relative values α/α_D are probably reliable within one or two units in the last figure.

Table of Wave-lengths used in the Measurement of Rotatory Dispersive Power, together with the rotations produced by 100 mm. of Methylic Camphocarboxylate at 20° C.

	w.l.	α .	α/α_D .		w.l.	α .	α/α_D .
Li red	6708	$48^\circ 32$	0.728	Cu green	5154	$94^\circ 93$	1.430
Cd red.....	6438	$53^\circ 41$	0.805	Cu green.....	5105	$97^\circ 52$	1.469
Zn red.....	6364	$54^\circ 91$	0.827	Cd green.....	5086	$98^\circ 60$	1.486
Na yellow ...	5893	$66^\circ 37$	1.000	Zn blue	4811	$116^\circ 15$	1.750
Hg yellow ...	5790	$69^\circ 40$	1.046	Cd blue	4800	$116^\circ 93$	1.762
Cu yellow ...	5782	$69^\circ 83$	1.052	Zn blue	4722	$122^\circ 92$	1.852
Hg yellow ...	5769	$70^\circ 09$	1.056	Cu blue	4705	$124^\circ 38$	1.874
Cu yellow ...	5700	$72^\circ 38$	1.090	Zn blue	4680	$126^\circ 36$	1.904
Ag green.....	5469	$80^\circ 75$	1.217	Cd blue	4678	$126^\circ 55$	1.907
Hg green.....	5461	$80^\circ 94$	1.220	Cu blue	4651	$128^\circ 34$	1.933
Tl green	5351	$85^\circ 59$	1.290	Cu blue	4587	$134^\circ 60$	2.028
Cu green	5219	$91^\circ 73$	1.382	Cu violet.....	4378	$157^\circ 62$	2.375
Ag green.....	5209	$92^\circ 17$	1.389	Hg violet.....	4359	$165^\circ 07$	2.487